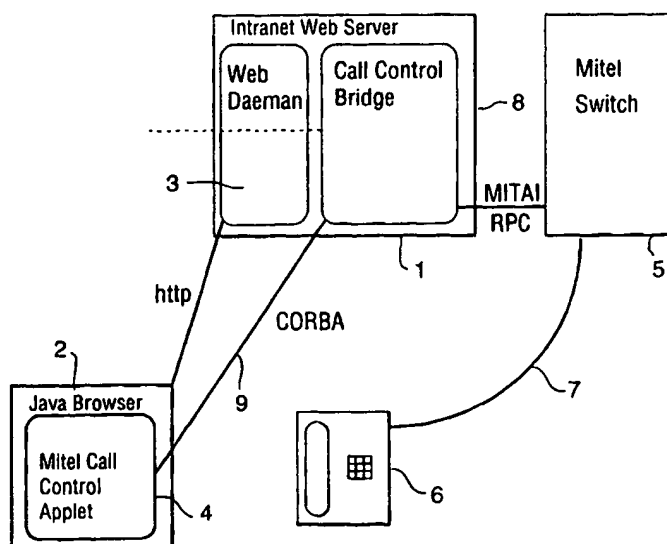




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(54) Title: NETWORK CONTROL OF TELEPHONY SERVICES USING DOWNLOADABLE APPLICATIONS

**(57) Abstract**

A remote call control system comprises a local area network, a network server, a call control server, a plurality of client machines connected to the network server over the local area network, and a telephone switch responsive to instructions from the call control server using a call control protocol to establish connections between telephone sets. Call control applets are downloaded on demand from the server to the client machines for running on the clients. A call control bridge for passes control messages between the applets running on the client machines and the call control server to permit a user operating a client machine to exercise selective control over calls controlled by the call server.

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- 1 -

NETWORK CONTROL OF TELEPHONY SERVICES USING DOWNLOADABLE APPLICATIONS

This invention relates generally to the field of telephony, and in particular to a remote call control system for use in a local area network environment.

The Telephony industry has provided a large set of features for managing and controlling telephone calls. Generally users have had to use either the limited interface of their telephone or expensive add-on applications with specific set-up environment requirements. Now that public telephone companies are providing many of these same features to their users through such features as Centrex, the problem is moving past the private branch exchange (PBX) and into the home. Both business and home users are faced with trying to figure out how to do simple tasks, such as call forwarding, using arcane DTMF and switch-hook sequences.

Studies show that of the dozens of features offered on modern PBXs, only a small number are usable by the average user. The transferring of a call is often preceded by a warning such as "if I lose you...". Other features, which may be useful to the user, are too difficult to access or are totally invisible.

Client Call Management applications which provide the user with an interface on a computer for controlling telephones have emerged as one alternative. They provide easier access to features and customization of telephony requirements. Unfortunately, such applications tend to be costly, difficult to install and maintain, and are limited in platform availability. For these reasons, they have tended to be limited to specific high demand users, such as call centres. The typical low-demand user has not been able to benefit from the enhanced interface available within a computer's graphical user interface. For many businesses, this has led to the purchasing of expensive telephone sets for their PBX system, which only provide limited extra functionality.

An object of the invention is to alleviate this problem.

According to the present invention there is provided a remote call control system comprising a local area network, a network server, a call control server, a plurality of client machines connected to the network server over the local area network, a telephone

- 2 -

switch responsive to instructions from said call control server using a call control protocol to establish connections between telephone sets, means for downloading on demand call control applets from said server to said client machines for running on said clients, and a call control bridge for passing control messages between said applets running on the client machines and said call control server to permit a user operating a client machine to exercise selective control over calls controlled by the call server.

The invention makes use of platform independent mobile and downloadable software components in distributed computing environments. A downloadable application can be provided which is platform independent and does not need to be installed or maintained on the client machines. Such an application, with a communication path back to a telephone switch, can provide enhanced telephony notification and control to any user with a net-work connected computer.

This invention thus provides a general framework for implementing a mobile telephony client which can use a distributed environment for remotely controlling a telephony server or switch.

The invention will now be described in more detail, by way of example, only with reference to the accompanying drawings, in which the single figure is a block diagram of a remote call control system in accordance with the invention.

Referring to the Figure, a local area network comprises a network application server 1 and a plurality of client machines 2 connected to the application server in a conventional manner, for example, using an Ethernet connection. The application server 1 includes a Web Daemon 3 for providing HTML documents and Java applets. The client machine 2 includes a Java-enabled web browser 4 capable of running Java applets downloaded from the web browser 4.

Java is a hardware-independent interpreted language from Sun Microsystems, which enables mini-programs or "applets" to be downloaded from the server and run on the client machines 2.

A PABX 5, such as a Mitel corporation PABX, is connected to telephone sets 6 over telephone lines 7. The PABX has a MiTAI, Mitel Telephony Application Interface,

- 3 -

and is responsive to instructions in the MiTAI call control protocol to set up calls between telephone sets 6. Alternatively, TSAPI or TAPI interfaces could be used.

The application server 1 includes a call control bridge 8 connecting a call control server 9 to the switch 5. The bridge 8 exchanges messages with the call control server 8 using "COBRA", which stands for Common Object Request broker Architecture. The call control bridge 8 communicates with the switch 5 using the MiTAI interface. In addition, the call control bridge 8 communicates with the client machines 2 over the local area network.

The remote call control system thus consists of the application server 1, the call control server 9, a downloadable platform independent application (applet), and a platform and language independent communication protocol, and a client virtual machine that can download and run the applet.

The application server 1 sends the downloadable application or applet to the client's virtual machine 2 on demand. The applet is executed on the virtual machine 2 and sets up a COBRA connection with the call control server 9 via the call control bridge 8, thereby allowing the user of the client application control over some set of calls controlled by the call Server 9. The applet can register interest in certain events with the call server 9. When these events occur on the server, the applet is notified so that it can take the appropriate action, such-as popping up an "incoming call" window.

User I.D.s and passwords or IP mapping tables can be used for identifying access levels and matching the application to a telephony line. Both individual and group line management services can be provided. Remote debugging of switches and whiteboard conferencing between parties in a call can also be provided.

In the preferred implementation, Hypertext Transport Protocol and associated Hypertext Markup Language browsers are used as the client interface. Sun Microsystem's Java language serves as the platform independent application language. CORBA, the platform independent standard for distributed object message passing, provides messaging between the client applet and the Call Control Server.

- 4 -

The call control bridge 8 exports CORBA objects to client machines and interacts using standard telephony APIs to the PBX 5 controlling the telephone calls.

The Java Applet which registers with the call control bridge and provides control and notification of calls to the client's desktop.

In operation, when the Java-enabled Web browser accesses the Call Control HTML page on the Server, the browser downloads a Java Applet which includes classes for a Java CORBA Object Request Broker. In this way, CORBA is distributed to the clients on an as-needed basis. No installation, customization or management of client-side machines is required, as long as they have a Java enabled browser. When started, the Java applet on the client machines presents a log-in screen. When the user logs in, the applet uses the CORBA classes to connect to the server and then ex-changes object references with the server. A window is created on the client machine that allows the user to use the Call Control applet even as they move on to browsing other Web pages. Asynchronous messages from the server are handled by the applet to update the applets state; in particular, incoming call events cause the applet to pop a window up on the user's screen to alert them to the incoming call.

The invention thus enables a user on a client machine to have selective access to telephone control features on an as needed basis.

The invention can thus provide the control of telephony switches through downloadable applications, the notification of calls through downloadable applications, the control of telephone calls through a World Wide Web HTML browser, such as Netscape, the provision of a COBRA to Telephony API bridge for object oriented telephone calls, client to telephony permission mapping through network addressing, remote debuggin of telephony switches through wide area networks, and data transfer between parties over wide-are networks coordinated with standard telephony calls.

- 5 -

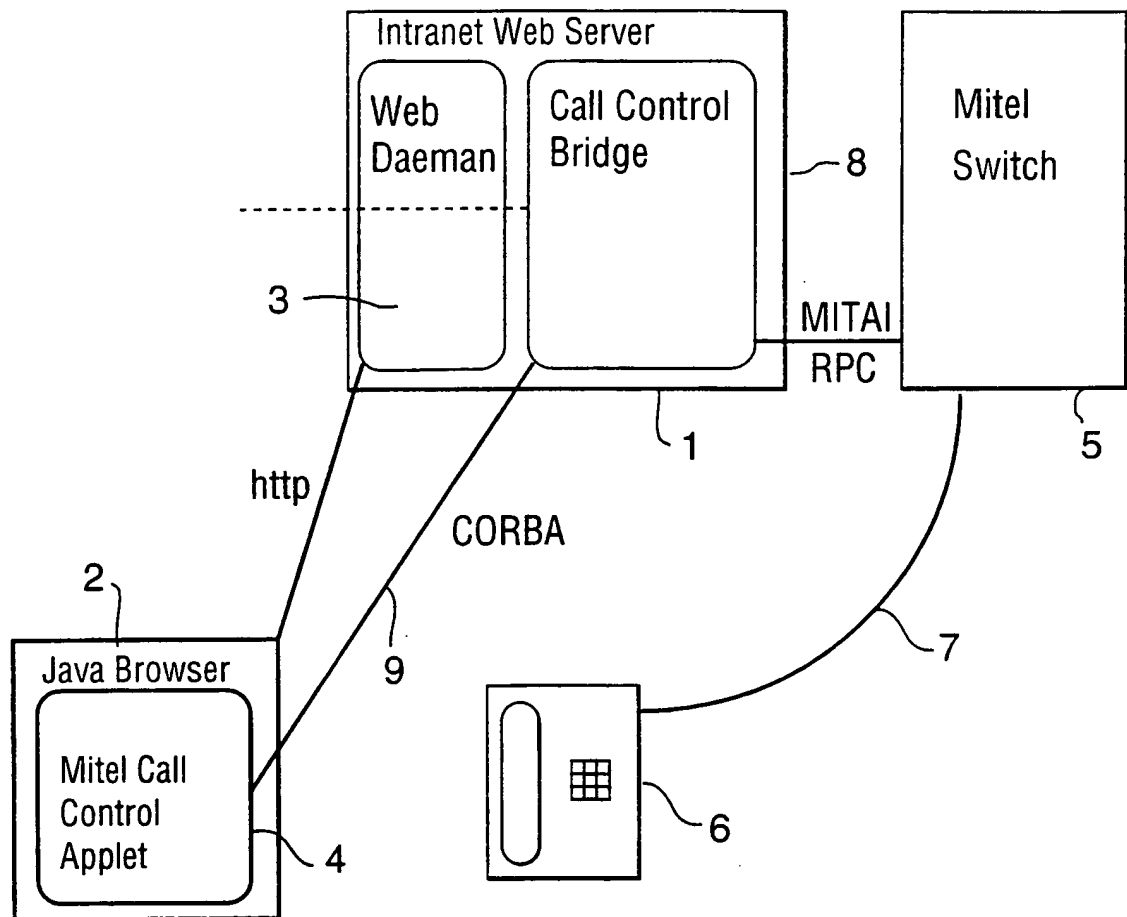
Claims:

1. A remote call control system comprising a local area network, a network server, a call control server, a plurality of client machines connected to the network server over the local area network, a telephone switch responsive to instructions from said call control server using a call control protocol to establish connections between telephone sets, means for downloading on demand call control applets from said server to said client machines for running on said clients, and a call control bridge for passing control messages between said applets running on the client machines and said call control server to permit a user operating a client machine to exercise selective control over calls controlled by the call server.
2. A remote call control system as claimed in claim 1, wherein said network server includes a call control bridge for exchanging messages between said applets and said call control server using object oriented control of calls.
3. A remote call control system as claimed in claim 2, wherein call control server is connected to said switch through a telephony Application Programming Interface.
4. A remote call control system as claimed in claim 3, wherein said network server includes a web daemon, and said client machine includes a web browser for accessing a call control page on said web daemon.
5. A remote call control system as claimed in claim 1, wherein said web browser is Java-enabled for running a Java call control applet on the client machine.
6. A remote call control system as claimed in claim 1, wherein said applets provide notification of calls to users of client machines.
7. A method of controlling telephone calls from a client machine in a local area network environment, comprising downloading on demand call control applets from a network server to client machines, for running said applets on said clients, passing control messages between said applets running on the client machines and a call control server to permit a user operating a client machine to exercise selective control over calls setup by a switch controlled by the call server.

- 6 -

8. A method as claimed in claim 7, wherein said messages between said applets using object oriented control of calls.
9. A method as claimed in claim 8, wherein said applets are accessed using a web browser running on a said client machine.
10. A method as claimed in claim 9, wherein said web browser is Java-enabled.
11. A method as claimed in claim 7, wherein said applets provide pop-up windows to offer notification of calls to users of client machines.

1/1



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INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04M3/00 H04M3/42 H04Q3/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	LOW C: "THE INTERNET TELEPHONY RED HERRING" HP LABORATORIES TECHNICAL REPORT, 15 May 1996, pages 1-15, XP002043901 see the whole document ---	1-11
X	LOW C ET AL: "WEBIN - AN ARCHITECTURE FOR FAST DEPLOYMENT OF IN-BASED PERSONAL SERVICES" WORKSHOP RECORD. INTELLIGENT NETWORK. FREEDOM AND FLEXIBILITY: REALISING THE PROMISE OF INTELLIGENT NETWORK SERVICES, 21 April 1996, pages 1-12, XP002043670 see the whole document ---	1-11

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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	WO 97 22211 A (HEWLETT PACKARD CO ;LOW COLIN (GB); PENKLER DAVID (FR); BOUTHORS N) 19 June 1997 see abstract see page 16, line 13 - page 18, line 16 see page 33, line 18 - page 34, line 17 see figures 13-18 ----	1-11
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